STRUMENTI SCIENTIFICI

S.r.l.

Hydrogen generator AD Series

User's manual

Version 1.1

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Introduction

Scope of the manual

This manual provides operation an maintenance instructions for all model of hydrogen generator AD Series.

Specifications

Specifications of the hydrogen generator AD Series

Hydrogen flow rate range **STP**: Standard temperature and pressure (20°C at 1 bar)	**MODEL AD-100 0-100 cc/min at STP** **MODEL AD-180 0-180 cc/min at STP** **MODEL AD-260 0-260 cc/min at STP** **MODEL AD-450 0-450 cc/min at STP** **MODEL AD-510 0-510 cc/min at STP** **MODEL AD-650 0-650 cc/min at STP** **MODEL AD-770 0-770 cc/min at STP** **MODEL AD-930 0-930 cc/min at STP** **MODEL AD-1020 0-1020 cc/min at STP**	
Min. outlet pressure	**2 bar (29 psi)**	
Max. outlet pressure	**10.7 bar (157 psi)**	
Standard purity	**99.9999% at STP**	
Input voltage	**115 V/60 Hz**	**230 V/50 Hz**
Fuse type	**N.2 5x20mm 6,3A type T**	
Power consuption	**MODEL AD-100 090 VA** **MODEL AD-180 125 VA** **MODEL AD-260 160 VA** **MODEL AD-450 265 VA** **MODEL AD-510 300 VA** **MODEL AD-650 340 VA** **MODEL AD-770 400 VA** **MODEL AD-930 485 VA** **MODEL AD-1020 530 VA**	
Pressure accuracy	**≈ 0.1 bar (1 psi)**	
Microprocessor controller color display	**Graphic colour display, 128x64 pixel**	
Operating conditions: **- Temperature** **- Relative humidity**	**+5°C to +40°C/ +41°F to 105°F** **0-80% non condensing**	
Index of protection	**IP20**	
Over voltage category	**II**	
Sound pressure level	**< 40 dB (A)**	
Weight	**MODEL AD-100**	
	MODEL AD-180	

	MODEL AD-260	
	MODEL AD-450	
	MODEL AD-510	
	MODEL AD-650	
	MODEL AD-770	
	MODEL AD-930	
	MODEL AD-1020	
Case dimension	**339x553x445 mm (WxDxH)**	

Notes on FCC compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following mearures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING!

Any changes or modifications to this equipment not expressely approved by the manufacturer may void the user's autority to operate the equipment.

Correct use

Hydrogen generator is designed to produce hydrogen for laboratory use. The units must only be operated for this purpose, according to the specifications and instructions provided in this manual. In particular, the following warnings must be observed at all times:

- Indoor use only. Do not operate outdoors.
- Never operate the unit in below-zero temperatures.
- Only operate the unit in a room with sufficient ventilation (see “Placing the unit”).
- Always unplug the unit from the mains power supply before accessing the internal components for replacement.
- Only the parts described in the “Spare parts list” can be replaced by the user.

Health and safety

Important: Do not operate this equipment before reading the instructions in the user guide. Use of the equipment in a way not allowed by this user guide may compromise the protection of the generator and could cause a wrong release of pressure which may cause serious personal injury or damage.

Correct use of the hydrogen generator is important for your personal safety and for trouble-free functioning of the hydrogen generator. Incorrect use can cause damage to the hydrogen generator or can cause an incorrect gas supply.

Warning:

- Read this manual before you start the installation and putting into operation of the hydrogen generator Ad Series.
- Contact your supplier if you detect a problem that you cannot solve with this manual.
- Only service-engineers, that are qualified to work on electric and pneumatic equipment, are allowed to do installation, maintenance and repairs. Unqualified people are not allowed to repair the equipment. Lift the hydrogen generator AD Series with a forklift. Follow the legislation and instructions for operating the forklift.
- Do not tamper or experiment with the equipment. Do not exceed the technical specifications for the hydrogen generator AD Series.

Warning: hydrogen and oxygen

- Hydrogen is highly flammable gas. Keep the generator away from excessive heat and naked flames.
- The accumulation of hydrogen can displace oxygen, thereby creating an asphyxiation hazard.
- Always ensure that the generator in operated in well ventilated area and all of the vent ports on the rear of the generator are kept clear and free from blockages.

- The hydrogen generator AD Series is not designed for installation in an Exx-classified area.
- Do not install hydrogen generator AD Series in an area where exsplosive mixsture may occure.

Warning: electricity

- Ensure that the equipment is depressurized and electrically isolated, prior to carrying out any of the scheduled maintenance instructions specified within this user guide.

- Only service-engineers, that are qualified to work on electric equipment, are allowed to do the installation, maintenance and reparations.
- Disconnect the main power supply before you do the maintenance or repair.
- If a service-engineer has to work on the hydrogen generator AD Series while the electric power it is connected, the service-engineer must be very careful with respect to the electric hazards.

Warning: safety precautions

- Keep the ambient temperature between + 15 ℃ and 40 ℃.
- Do regular maintenance to the hydrogen generator AD Series.

Packing list

List of items included in the shipment

Quantity	Description
1	Hydrogen generator
1	Instruction manual
1	Deioniser bag
1	Water drain with flexible tubing
1	Power cable

Description

The gas generator will produce a constant stream of hydrogen at a pre-determined pressure and flow rate when connected to a suitable power supply and fed with a suitable quality of de-ionized water. The hydrogen generator AD Series produces pure hydrogen (and oxygen as a by-product) by the electrolysis of water. The key element of the hydrogen generator is an electrochemical cell assembly which contains a PEM, proton exchange membrane. No free acids or alkalines are used. De-ionized or pure, distilled water is the only liquid which may came into contact with electrolytic cell. As this is consumed it must be refilled from time to time as required.

It should be noted that Hydrogen generator AD Series must be installed and activated in not more than three months from the dispatch by CINEL Strumenti Scientifici, to ensure the optimum efficiency of the PEM. Failure to do this can invalidate the warranty.

The hydrogen gas is generated in the electrolytic cell by electrolysis of liquid water. Hydrogen gas is accumulated in the automatic gas liquid separator and desiccant column. The internal and external pressure are controlled by a pressure transducer. The outlet flow of hydrogen gas is controlled by a proportional valve. The hydrogen gas is dried by passing through the automatic dryer system. The hydrogen gas then passes through outlet port at the rear.

Installation

Receiving the generator

All units have been carefully inspected before transport. Visual checks for damage and functional tests should be performed upon receipt. Any damage must be immediately noted and reported. The generator must only be returned according to the shipping instructions provided.

Placing the generator

The hydrogen generator must be placed on a flat, level, vibration-free, shock-free surface. Do not place the generator over a source of heat, as this may cause the device to overheat. The unit should not be in contact with any other objects on any side, and the air inlet must not be blocked. **Leave at least 30 cm of free space at the rear for ventilation.** Do not operate the generator in a sealed or unventilated room, or in close proximity to open flame or other sources of ignition. Do not operate the generator at below freezing temperatures. **Operation is guaranteed at operating temperatures between +5 and +40℃.**

WARNING!

Normal precautions for any hydrogen supply should be taken when using the geneator.

DO NOT use in sealed or unventilated rooms. Hydrogen can causate suffocation.

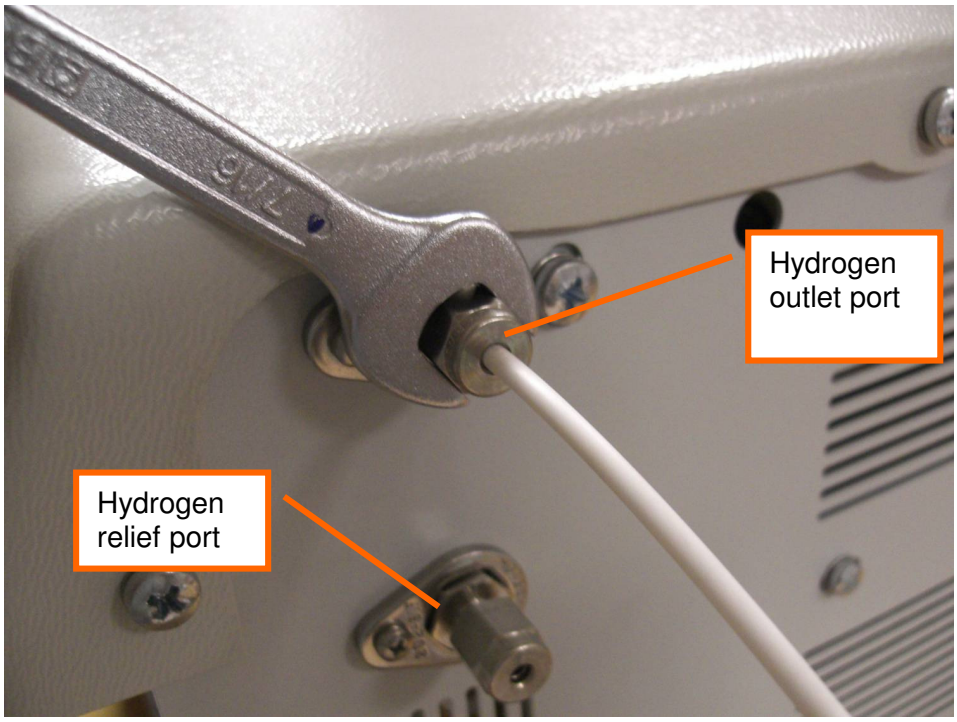
Symbols used on the generator

⏚	Earth symbol: this symbol marks the earth connections to the chassis of the hydrogen generator.

⚡	Electric shock: Risk of electric shock, highlights actions or procedures which, if not performed correctly, could lead to electric shock.

Gas connections

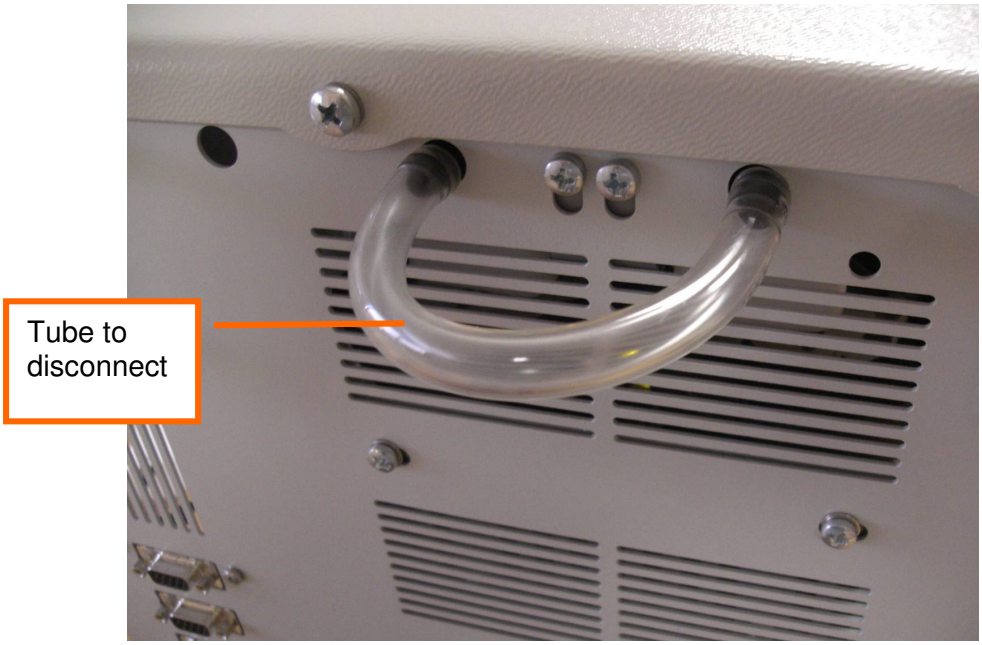
Pure dry hydrogen at regulated pressure is available at the hydrogen outlet port at the rear of the generator. This port must be connected to 1/8” tubing using a stainless-steel Swagelok connector. Teflon connectors are not suitable. The pressure at this port is adjusted and shown on the display. The hydrogen relief port at the rear of the unit can be connected to an exhaust hood or other vent system.



WARNING!

The line from the relief port should never be connected in such a way that back pressure can develop.

REMOVE THE TUBE from the oxygen vent and hydrogen vent before operating unit. Keep these tube for transporting the unit.



INITIAL START-UP

Filling the water tank

To fill the water, remove the cap on the top of the generator. Carefully fill the tank with distilled or deionised water.

The conductivity of the water used in the generator must be less of 1 Mohm·cm
(1 Mohm·cm = 1 $\mu S \cdot cm^{-1}$)

Rinse the water tank and internal water piping by filling and draining the tank of the generator three times with required quality of deionised water. Fill the generator tank manually to the max level indicator and then empty the water out by inserting the drain fitting. Repeat for a total of three fills and drains. Remove the drain fitting after the final drain.

Check that the ion exchange resin bag is inserted into the water tank.

WARNING!

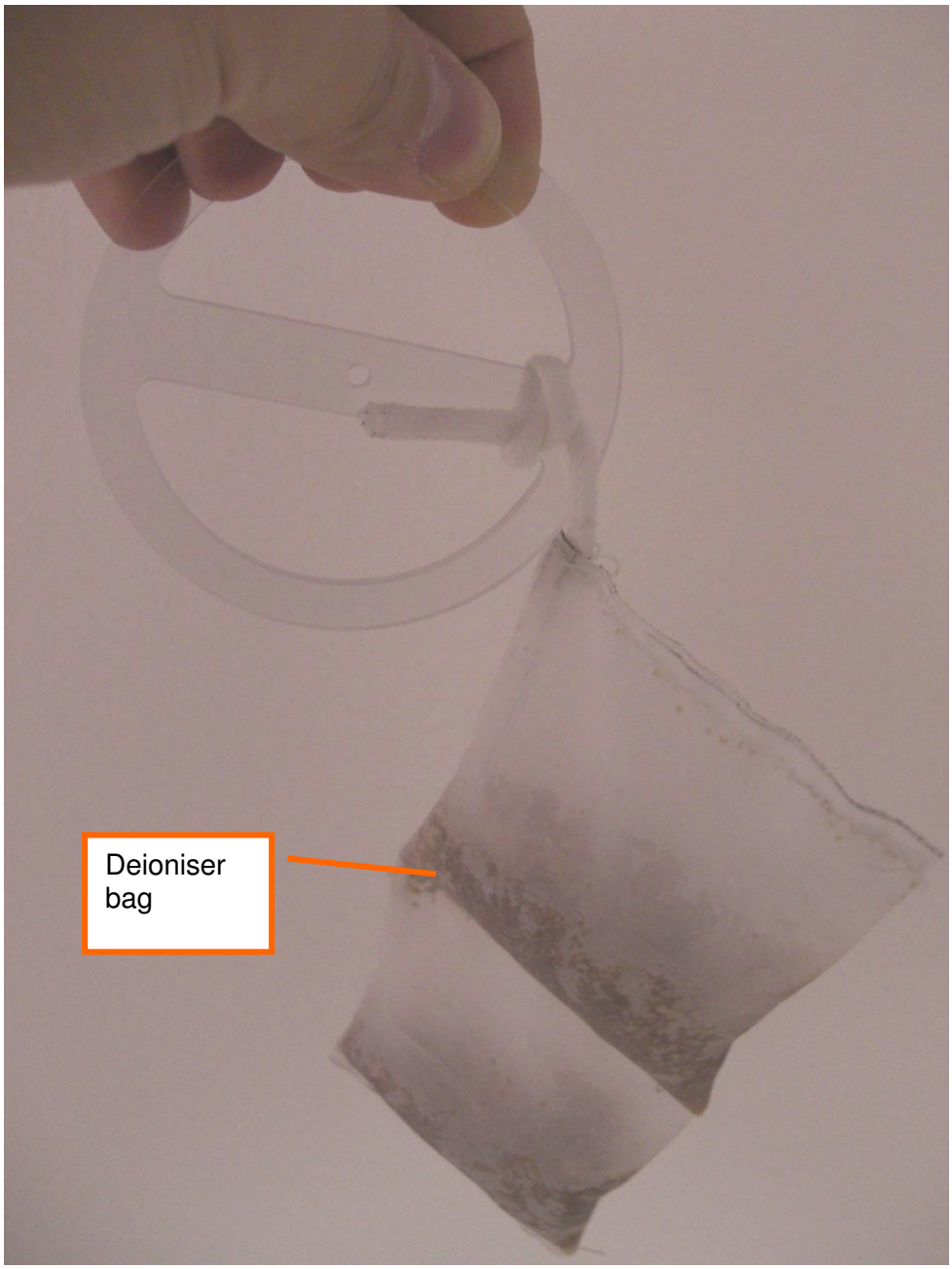
Use only deionised water

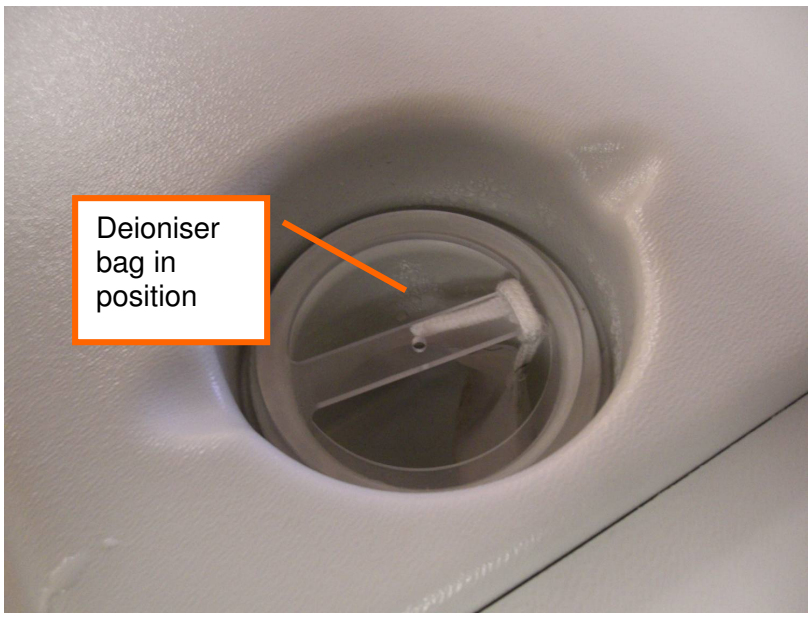
Do not fill the water tank higer the marked level

To prevent contamination of the electrolytic cell, it is important to use only deionised or distilled water in the generator. Water containing ions will contaminate or damage the cell, and will void the warranty.

Installing the deioniser bag

The deioniser bag has been developed for a higher water purity capacity. It is recommendable to change this bag every three - four months.





Start Hydrogen Generators AD Series

Switch on the unit.

The operating status of the unit is shown on the main screen on the graphic display.

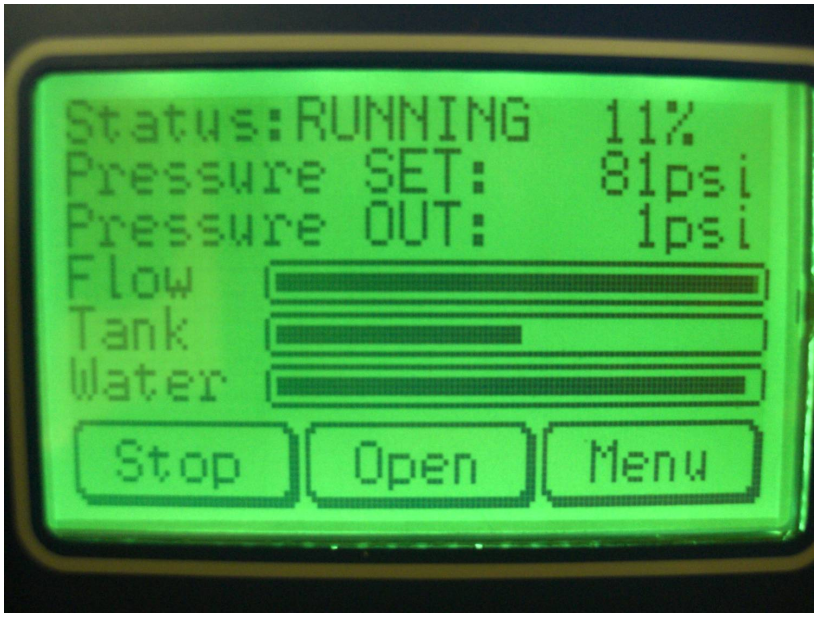
"Flow" Current flow in cc/min being produced by the generator. This is for indication only and we recommend the use of a flow meter to gain an accurate measurement.

"Tank" indicate the level of water in the internal tank of the generator.

"Water" indicate the quality of water.

1)Press start button.

The status of the machine change from stand-by to running and the color of the graphic display change from **blue** to **green**.

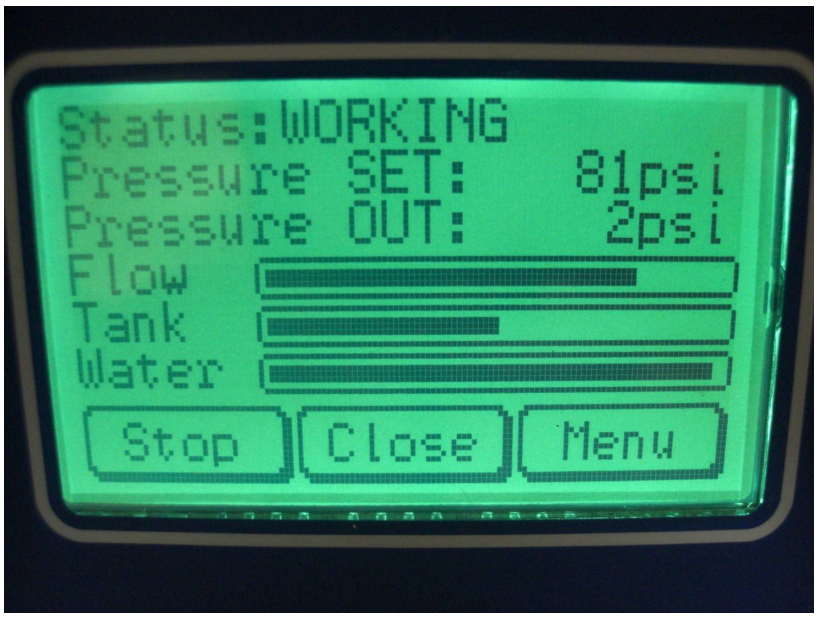


2) Wait until the value of percentage is 100%.

3) At this moment press open button.

The status of the machine change from ***running to working.***

The output pressure of hydrogen increase to the value of set point.



4) For set the pressure set point press menu button.

Select “Pressure Set”.

Set intended value.

Select “Exit” to return in main menu.

Select “Exit”.

Stopping the equipment and depressurizing

For stopping the hydrogen generator press the “Close” button for close the outlet valve. Then, press “Stop” button for depressurized the internal pressure of hydrogen.

WARNING!

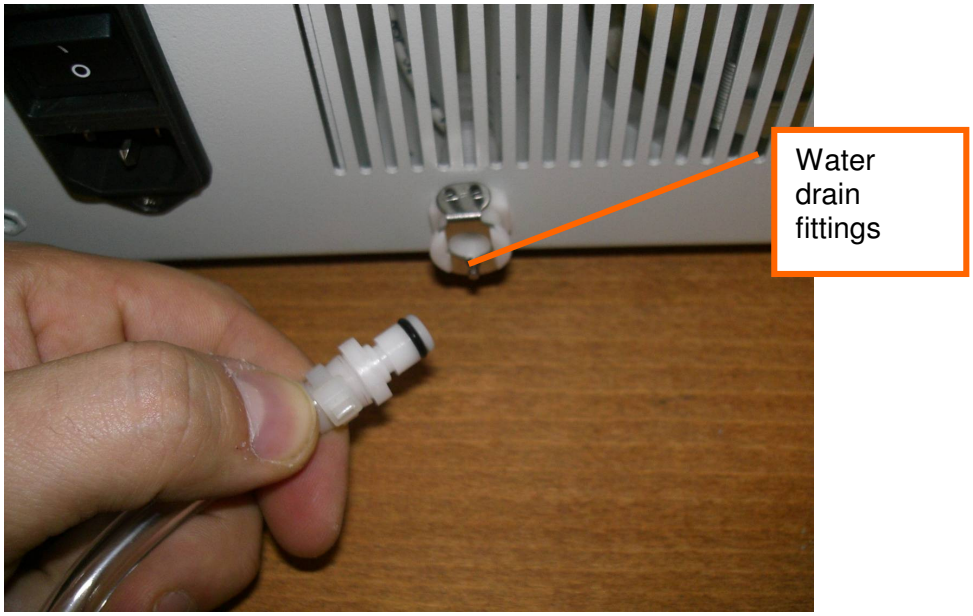
The equipment contains pressurized hydrogen gas. Ensure that it is fully depressurized prior to shipment or servicing.

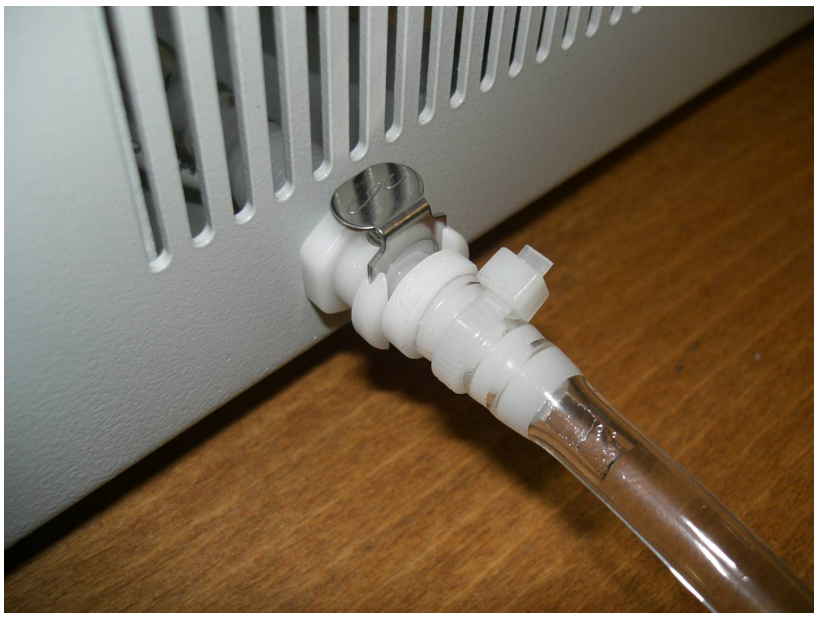
Switch off the unit and disconnect power supply cord.

Water drain procedure

Use the following instruction if it becomes necessary to replace the water in the hydrogen generator due to poor water quality or for return the unit:

- Switch off the unit.
- Disconnect the power.
- Drain the water using the system water drain fitting on the back of the generator.





The drain valve opens when the mating male fitting is inserted into the drain valve.

WARNING!

Do not re-use the old water.

Overwiew of writing “WATER”

The writing “Water” gives a graphical indication of the water quality. When all line is shaded the water quality is to specification. When the line shaded drops under a default value the “Change Water” pre-alarm will be displayed and an intermittent alarm will sound. **Hydrogen will continue to be delivered to the application.**

If the water quality degrades further the outlet valve of the generator will be closed and a Bad Water error generated. The graphic display will illuminate red and a alarm will sound. **Hydrogen will not be delivered to the application.**

The water tank should be drained and refilled with deionised water ASTM II, > 1 Mohm-cm at the earliest convenient time.

Because residual ions can build up in the water recirculation system, Cinel Strumenti Scientifici recommends that you consider a monthly drain and refill your Hydrogen generator AD Series. While this maintenance is not required in order to comply with the system warranty, a monthly drain and refill of the internal water tank with fresh, high quality water (Deionised, ASTM II, > 1 Mohm-cm) helps to ensure the longest possible life from the hydrogen generator cell stack.

How to change the fuses

Switch off the unit and disconnect power supply cord. Open the fuses box.

Change N° 2 fuses (5x20 mm, 6.3 A, type T)

Menu stucture

Pressure Set

In this menu is possible to set the out intended pressure of hydrogen

Setup

Set clock: Allow the regulation of the clock of the unit. The central button of the display increase the values and the left button passes to the next number.

Press.Drop Delay: Set a delay in minute to ignore a output pressure drop (override low pressure alarm).

Autostart: Sets whether the unit automatically starts production when power is switched on.

Pressure unit: Set the desired unit of measure for the pressure.

Temperature unit: Set the desired unit of measure of the temperature.

Set default values: Set all configuration parameters to default.

Refill

History Alarm

Shows the history of the alarm occurred on the unit

Diagnostic

Item	***Description***
Life Time	Total number of hours the unit operation
Cell V.Peak	The maximum cell voltage in the life of the cell
Cell V.	Actual cell voltage
Cell I.Peak	The maximum cell current in the life of the cell
Cell I.	Actual cell current
MB T.Peak	The maximum Main Board temperature in the life of the cell
MB T.	Actual Main Board temperature
Int.Press.	Actual internal pressure of the unit
Dryer 1 T.	Actual temperature of the dryer 1

Dryer 2 T.	Actual temperature of the dryer 2
P.Trans.1 T.	Actual temperature of power transformer 1
P.Trans.2 T.	Actual temperature of power transformer 2
Water Quality	Actual water conductivity

Test

Internal Leak: The outlet valve is closed, the internal pressure is set to the max. When the internal pressure reaches the max., production of hydrogen is stopped and the pressure drop is measured over two minutes. After the test the generator gives a result, passed or failed.

External Leak: Work similar to the leak internal except the outlet valve is open and the test pressure is equal to the pressure set. When the pressure out reach the pressure set point the outlet valve is closed and pressure drop is measured over two minutes.

This function can be used to test the external gas lines.

Heaters: This test checks if there is a reaction of the heaters temperature when the power is applied.

Valves: This test switch on/off the electro-valves. When an electro-valve is switch on you will can see the green light and hear a sound.

This test is only for service-engineers

Manitenance

With proper care and maintenance, your hydrogen generator should provide you with years of trouble-free operation. There are no adjustments to be made to the generator. The only routine service operations are those described below.

Cleaning

Clean only the outside of the generator. Disconnect the generator power cord before cleaning the generator. To clean the outside of the equipment only use a damp sponge or soft cloth.

WARNING!

To avoid marring the plastic surfaces, do not use acid or abrasive cleaners on the generator.

Water refilling

The water tank must be refilled when the water level approaches the lower level, and the Refill Water pre-alarm message appears. It is possible refill the generator during operation.

Deionizer bag replacement

Rinse the water tank and replace the deionizer bag approximately every three months, or whenever the Change Water message appears. For installing a new deionizer bag see page **"Installing the deioniser bag"**.

Returning the unit

In the event of any faults or damage, first notify the agent or distributor who supplied the unit. Please also provide full details of the problem, including the model and serial number. Instructions will then be provided for the service or the return of the unit. If the one year warranty has expired, or the fault is due to misuse of the unit, all repair and shipping costs are to be paid by the customer. All other costs are borne by the customer, except as otherwise expressly agreed upon.

WARNING!

If the unit has be transported, make sure that water tank is completely empty, and place the tube (supplied with unit) on oxygen and hydrogen vent at the rear of the unit. Close water tank with the cap.

WARNING!

The unit should be transported in an upright position; this warning should be reported on the outside of the packaging.